

## CHAPTER 4

## DESIGN CONSIDERATIONS

## 4-1. Architectural.

a. The total architectural design should embody current industry and military standards. In the event of conflict, the more stringent standards will normally prevail.

b. The schematic design concept should be based on a simple, logical idea which satisfies the requirements of the program, site, user functions and long life maintenance. Each project is individual and requires a concentrated effort to develop the appropriate solution.

c. The materials and their methods of construction proposed for use on a facility must have been used (preferably by the Design Agency) in several projects which can be researched to ascertain the product's performance characteristics. Materials as well as the design must be able to stand the test of time.

d. The complete coordination of engineering discipline interface is the responsibility of the Design Agency. A check for structural, HVAC, electrical and plumbing and fire protection conflicts is an important aspect of the design process.

e. Interior finishes are similar in most of the individual spaces within larger functional areas. Table 4-1 is a suggested schedule of interior finishes.

f. Roof design is an especially important area of design. Consider the impact that the roof design has on drainage. Pitched roofs with gutters may avoid the use of costly interior roof drains.

g. Fenestration should be located where functionally appropriate. Consider the impact of window sizes, locations, eave overhangs, etc. on energy conservation. Operable windows should be provided, if possible, for ventilation flexibility. Window blinds on exterior windows should be used in offices and classrooms.

h. Consider passive solar designs, use of daylighting, increased wall and roof insulation, internal thermal mass and earth berms in the development of the architectural design. See section 4-7, energy conservation.

i. The following types of doors are typically used:

(1) Main exterior doors should be double doors with removable mullions and push-button combination security locks.

(2) Fire doors should be U.L. listed, with door and frame fire rated as required, and with panic hardware as required.

(3) Vault doors will be Class V as per AR 190-11.

(4) Classroom doors should be solid core with a minimum 40 STC rating, provided with a privacy lock, and should not be provided with glazing.

(5) Storage room doors should be solid core, provided with a latchset and dead bolt.

j . All doors should be 3 feet wide, minimum.

k. Signage for the building exterior and interior should be included in the project design. Building signage will be contractor supplied and installed. Refer to TM 5-807-10. See appendix B for list of typical signs required.

1. Recommended finishes for the training center building and maintenance facilities are described in table 4-1. Individual projects may require variations.

**TABLE 4-1. Finishes**

<u>FLOORING</u>		<u>BASE</u>	
CONC	Concrete	CT	Ceramic Tile
CPT	Carpet	GMU	Glazed Masonry Units
CT	Ceramic Tile	QT	Quarry Tile
QT	Quarry Tile - Abrasive	RB	Rubber
VCT	Vinyl Composition Tile		
<u>WALLS</u>		<u>CEILING</u>	
AFP	Acoustical Fiber Panel	ACT	Acoustical Ceiling Tile
CMU	Concrete Masonry Units	AFP	Acoustical Fiber Panel
CONC	Concrete (with hardener)	CONC	Concrete
CT	Ceramic Tile	EXP	Exposed Construction
-EP	Epoxy Paint	GWB	Gypsum Wall Board
-EXP	Exposed	WRGWB	Water Resistive GWB
GMU	Glazed Masonry Units		
GWB	Gypsum Wall Board		
MFG	Molded Fiber Glass		
-P	Paint		
PNL	Paneling		
WRGWB	Water-Resistive GWB		
WSCT	Hard Finish Wainscot		
C	Chair Rail		

TABLE 4-1. Finishes (Continued)

**TRAINING CENTER BUILDING**

SPACE	FLOOR	BASE	WALLS	CEILING	HEIGHT	NOTES
<b>Circulation:</b>						
Lobby	VCT	RB	GWB	-	9'-0"	
Corridor	VCT	RB	GWB-WSCT*	ACT	9'-0"	*Alternate: CMU-P
<b>Administrative areas:</b>						
Admin. offices	VCT*	RB	GWB**-C	ACT	9'-0"	*Alternate: CPT **Alternate: PNL
Retention office	VCT*	RB	GWB-P	ACT	9'-0"	*Alternate: CPT
Conference	VCT*	RB	GWB-P	ACT	9'-0"	*Alternate: CPT
Message center	VCT	RB	GWB-P	ACT	9'-0"	
Reproduction	VCT	RB	GWB-P	ACT	9'-0"	
Drafting	VCT	RB	GWB-P	ACT	9'-0"	
Communications	VCT	RB	GWB-P	ACT	9'-0"	
<b>Classroom area:</b>						
Classroom	VCT*	RB	GWB-P-C**	ACT	9'-0"	*Alternate: CPT **Movable Partition
Learning center	VCT*	RB	GWB-P-C	ACT	9'-0"	*Alternate: CPT
Library/classroom	VCT*	RB	GWB-P-C	ACT	9'-0"	*Alternate: CPT
Training aid storage	VCT*	RB	GWB-P	ACT	9'-0"	
<b>Assembly hall:</b>						
Assembly hall	VCT*	RB	CMU-P**	ACT	Varies 10'-0" min.	*Alternate: Hardened concrete **Alternate: GWB-P
Maint./chair storage	VCT	RB	GWB-P	ACT	10'-0"	

TABLE 4-1. Finishes (Continued)

**TRAINING CENTER BUILDING**

SPACE	FLOOR	BASE	WALLS	CEILING	HEIGHT	NOTES
Food prep.	QT	QT*	CMU-EP**	WRGWB**** w/Epoxy Paint	9'-0"***	*Alternate: GMU; CT **Alt.: GMU; CT ***Determined by exhaust hood clearance. ****Alternate: MFG
Food storage	QT	QT*	CMU-EP**	WRGWB*** w/Epoxy Paint	9'-0"	*Alternate: GMU; CT **Alternate: GMU; CT ***Alternate: MFG
Scullery	QT	QT*	CMU-EP**	WRGWB*** w/Epoxy Paint	9'-0"	*Alternate: GMU; CT **Alternate: GMU; CT ***Alternate: MFG
<b>Unit storage areas:</b>						
Unit storage	CONC	N/A	CMU-P*	EXP-P**	10'-0"	*Also caging where applicable. Use factory finished caging material. **Paint ceilings white.
Lockers	CONC	N/A	CMU-E**	EXP-P*	10'-0"	*Paint ceilings white. **Use factory finished caging material.
<b>General and special support areas:</b>						
Toilets	CT	CT	CMU-EP	WRGWB w/Epoxy Paint	9'-0"	
Showers	CT*	CT*	CT*	WRGWB	9'-0"	*Alternate: MFG
Janitor's closet	CONC	N/A	CMU-EP	ACT	9'-0"	
Mechanical	CONC	N/A	CMU-E*	EXP*	-	*Walls and ceiling to be sealed.
Arms vault	CONC	N/A	CONC*	CONC*	8'-2" min.	*Walls and ceiling to be sealed.
Rifle range	CONC	N/A	AFP* CMU-E	AFP* CMU-E	9'-4"	*Walls and ceiling to be sealed. See Standard Drawing for acoustical treatments.
<b>Medical wing:</b>						
Corridor	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Waiting	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P

TABLE 4-1. Finishes (Continued)

## TRAINING CENTER BUILDING

SPACE	FLOOR	BASE	WALLS	CEILING	HEIGHT	NOTES
Dressing	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Medical exam	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Dental exam	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Laboratory	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Toilets	CT	RB	CMU-P*	WRGWB	9'-0"	*Alternate: GWB-P
Sterile supply	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Dark room	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Eye exam	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
General supply	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Pharmacy	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Photo labs	VCT	RB	GWB-EP	ACT	9'-0"	
Soils testing lab	VCT	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
SCIF	Carpet	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Band room	Carpet	RB	CMU-P*	ACT	9'-0"	*Alternate: GWB-P
Organizational maintenance shop:						
Shop office	VCT	RB	CMU-P*	GWB-P	8'-0"	*Alternate: GWB-P
Work bay	CONC	N/A	CMU-P	EXP	15'-0" min.	
Tool and parts	CONC	N/A	CMU-P*	EXP-P**	10'-0"	*Alternate: GWB-P. Use factory finished caging material. **Paint ceiling white.

TABLE 4-1. Finishes (Continued)

## TRAINING CENTER BUILDING

SPACE	FLOOR	BASE	WALLS	CEILING	HEIGHT	NOTES
Storage	CONC	N/A	CMU-P*	EXP-P**	10'-0"	*Alternate: GWB-P. Use factory finished caging material. **Paint ceiling white.
Battery	CONC*	N/A	CMU-P**	EXP-P**	10'-0"	*Seal floor with acid resistant sealer. **Alternate: GWB-P. Use factory finished caging material. ***Paint ceiling white.
Toilets	CT	CT	CMU-EP*	WRGWB-EP**	8'-0"	*Alternate: GWB-P **Epoxy paint on ceiling.
Flammable storage	CONC	N/A	CMU-EXP*	EXP-P**	10'-0"	*Use factory finished caging material. **Paint ceiling white.
Mechanical	CONC	N/A	CMU-EXP	EXP-P*	10'-0"	*Paint ceiling white.
<b>Area maintenance support activity:</b>						
Small arms shop & vault*	CONC	N/A**	CMU-P***	EXP	8'-2" min.	*Seal all exposed finishes. **Alternate: RB ***Alternate: GWB-P
Supply	CONC	N/A	CMU-P*	EXP-P**	10'-0"	*Use factory finished caging material. **Paint ceiling white.
Comm./elec. repair	CONC	N/A	CMU-P*	ACT	8'-0"	*Alternate: GWB-P
Break	VCT	RB	CMU-P*	ACT	8'-0"	*Alternate: GWB-P
Lockers	CONC	RB	CMU-P*	ACT	8'-0"	*Alternate: GWB-P
Toilets	CT	CT	WRGWB*-EP	WRGWB*-P	8'-0"	*Alternate: GWB-P

## 4-2. Structural.

a. The structural system should be the most cost effective design without restricting the architectural and engineering aspects of the building such as flexibility, function, character, and symmetrical configuration for seismic resistance. A variety of systems shall be considered and the one selected must satisfy the site, flexibility, future expansion, program, economic and availability requirements. Systems such as steel post and beam or long span

bar joist, precast, tilt-up concrete tees, etc., should be considered. However, a very economical system is masonry load bearing walls with steel joists and metal deck. Consider also heavy timber construction and pre-engineered buildings.

b. The structural design and construction materials and methods must conform to current industry and military standards.

c. In addition to the structural design criteria in DOD 4270.1-M, the seismic capability of existing structures must be evaluated. The analysis should be implemented as follows:

(1) A seismic evaluation of existing facilities will be limited to those in seismic zone 2 and above except for structures in seismic zone 1 which have large, long span systems, or which are two stories or more. For most buildings in seismic zones 1 and 2, the wind load may govern the design.

(2) The seismic evaluation analysis will be carried to the extent necessary to determine a reasonable estimate of the life safety requirement (safety of personnel, i.e., to prevent collapse of building). Where complete design data and as-built drawings are not available, investigation of the structure will be made as necessary to perform the life safety evaluation and will be based on the following:

(a) Calculations will ordinarily be limited to the analysis of representative frames or load bearing shear walls in both directions of the structure. Seismic forces will be carried to the foundations.

(b) Roof and floor diaphragms will be investigated to transfer the lateral load to the frames or shear walls, particularly the connections.

(c) Non-reinforced masonry filler walls will be assumed to have no resistance capacity and will be susceptible to damage. However, if there are many of these walls which appear to provide substantial lateral load restraint without exceeding the allowable stresses, they may be considered as part of the seismic resisting system.

(d) When the strength of materials in concrete construction or the strength of the load-bearing masonry walls is critical for the investigation or in determining the necessary remedial measures, core samples will be taken and tested to determine the values to be used for developing the conclusions.

(e) Life safety of the existing structure is defined as meeting 80 percent of the lateral resistance (strength requirements) required by code. However, any strengthening or remedial measures to be provided will be designed to meet 100 percent of the lateral resistance of the code.

(f) Detailed requirements in TM 5-809-10 which directly apply to new facilities for ductility in frames, connections to account for walls, isolation of non-structural masonry walls, clearances to account for story drift and support of non-structural and mechanical and electrical elements should not be made applicable to existing construction. However, the existing

partitions and walls without lateral support at the top, or without straying from a relatively rigid ceiling system near the top, will be provided with lateral support against earthquake forces in accordance with TM 5-809-10. Mechanical and electrical equipment will be anchored for facilities in seismic zones 3 and 4. All new partitions, suspended ceilings, mechanical and electrical elements, and systems must be designed in accordance with TM 5-809-10 requirements.

#### 4-3. Mechanical.

a. Mechanical systems should be selected and designed in accordance with the requirements of DOD 4270.1-M. The emphasis of systems analysis should be placed on the occupancy profile for various areas of the building. Areas requiring only part time occupancy, with conditions being maintained at the unoccupied level the remainder of the time, will be isolated from the full time occupied area. Specific humidity control systems are not required except for arms storage vaults. Ventilation requirements listed in individual space criteria are minimums. Provisions will be made to introduce ventilation air only during the occupied hours of the specific space. System recommendation and general design guidelines for applications not specifically covered in this manual should be based on the latest recommendations of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Guide and Data Book.

b. Indoor design conditions for both unoccupied and occupied spaces for the various types of occupancy will be in accordance with table 4-3, Schedule of requirements, in this manual. Outdoor design conditions will be based on criteria listed in DOD 4270.1-M.

c. In general, factory fabricated, unitary mechanical equipment will be provided with attention given to proper access for maintenance and appropriate controls for both occupied and unoccupied maintenance of environmental conditions.

d. Use night set-back thermostats and time clocks to reduce building temperatures during unoccupied hours, and to provide automatic control. Thermostats should be provided with protective shields in exposed areas. Use mechanical ventilation or economizer cycles to meet the building's cooling requirements when practical. Consider the use of heat recovery equipment in areas with high ventilation requirements or to capture heat for domestic water preheating. Specifications should require the use of high efficiency components such as motors and low leakage dampers. Adequately sized pipes and ducts with smooth transitions, properly selected and protected with insulation should be installed in accordance with manufacturers requirements.

e. Mechanical room space will be as required; not borrowed from other space allocations.

f. Small occupied spaces remotely located from the majority of occupied spaces should be provided with small auxiliary HVAC units as authorized by DOD 4270.1-M.

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e. Mechanical room space will be as required; not borrowed from other space allocations.

f. Small occupied spaces remotely located from the majority of occupied spaces should be provided with small auxiliary HVAC units as authorized by DOD 4270.1-M.

g. Special equipment, such as computers or electronic telephone switchboards, may require special temperature and humidity controls.

h. Boilers should be provided with chemical treatment of water where required.

#### 4-4. Electrical.

a. The design for the electrical systems should include provisions of safe and economical electrical distribution, lighting, communications and signaling systems meeting present requirements and anticipated future growth.

b. The interior electrical distribution will be designed for the most efficient and economical distribution of energy, using the highest voltage consistent with the load served. A three-phase 208/120 volt system will generally be the minimum system employed, with consideration given to using a 480/277 volt system as service voltage where large equipment loads (relative to lighting and miscellaneous power) are encountered.

(1) Service and distribution equipment should be of the circuit breaker or fusible switch type. Branch circuit panelboards should be of the circuit breaker type.

(2) Provide a single main circuit disconnect device only if more than five circuits, not including the egress and emergency lighting disconnect, are fed from the main service switchboard.

(3) Egress and emergency lighting circuits (including battery back-up) should be on a separate main disconnect device.

(4) Direct burial type cables for exterior branch circuit wiring should be provided in lieu of conductors in conduit, except under paved areas.

(5) Types NMC and AC cable will not be used for interior wiring.

(6) Ground fault provisions will be as required by NFPA 70.

(7) Power panels and electrical equipment should not be located in range storage rooms, unit supply areas, chair storage or tool and parts storage areas. Shallow closets should be provided for electrical, telephone and auxiliary system equipment, where required.

(8) A 110 volt electrical duplex convenience outlet should be provided in each enclosed office, and in all areas of the facility, such that a 20-foot cord can reach any point on the floor with the exception of the assembly hall.

(9) Provide a fire alarm system with fused disconnect switches. A fused disconnect switch clearly marked and separate from the panel circuit breakers minimizes the possibility of inadvertently disconnecting these systems.

(10) Provide conduit for the intrusion detection system.

(11) Intrusion detection systems are not procured with project funds.

c. The exterior electrical system should include the following features:

(1) Primary electric service should be underground from the nearest pole to a pad-mounted, three-phase transformer located near the exterior of the mechanical equipment room or load center.

(2) Secondary electric service from transformers should be underground. Secondary service conductors should be in conduit.

(3) Consider hinged light poles for MEP lighting for remote locations.

e. The lighting system design objectives are to economically provide lighting levels for pleasant, efficient working conditions and effective night time vision for security.

(1) Lighting levels will conform to the footcandle levels established in the individual space criteria sections of this guide. DOD 4270.1-M applies to those areas and tasks not specifically covered.

(2) Consideration should be given to the use of non-uniform and task lighting layouts where applicable.

(3) Switching to provide reduced lighting levels in classrooms, assembly areas and other appropriate spaces should be provided.

(4) Fixture types should be as follows:

(a) Fluorescent lighting fixtures should be used throughout the facility. One tube size should be used to save operating costs and to reduce replacement problems.

(b) Use metal halide lighting fixtures in high bay areas for economy and good color rendition. Fluorescent lighting fixtures should be used to supplement the metal halide system and to provide immediate light response.

(c) Exterior security lighting, when required for the perimeter of buildings and parking areas, should be high pressure sodium vapor, controlled by photo-electric cells. Exterior security lighting should be provided at entrances to the building, at sidewalks from parking lots to the entrance, MEP and other areas as required. Site lighting should be kept off of adjacent property by directing the lighting toward the facility site. Vandal resistant lenses should be provided where required.

#### 4-5. Plumbing.

a. Plumbing systems should incorporate water and energy conserving fixtures and equipment.

b. Plumbing fixtures should be provided with vandal resistant features.

c. Hose bibs for landscaping should be provided on the exterior as required. However, to prevent unauthorized vehicle washing, do not locate hose bibs adjacent to parking areas.

d. Refer to TM 5-813-3 for hardness or other similar requirements.

#### 4-6. Fire protection.

a. Fire safety features should conform to DOD 4270.1-M and applicable standards of the latest edition of the National Fire Codes, published by the National Fire Protection Association (NFPA), or to the standards of the locally accepted building code, whichever is more stringent. Before fire sprinklers are used, the designer must study and provide alternative means of fire protection.

b. Provide a manual fire alarm and evacuation system designed in accordance with code requirements.

c. Illuminated exit signs and emergency lighting should be provided in accordance with NFPA 101, Life Safety Code.

d. Location of fire extinguisher cabinets and brackets should conform to NFPA 10 and should be furnished and installed by the contractor. Fire extinguishers will be furnished and installed by the government.

e. A comprehensive analysis and plan showing all fire protection features and systems should be developed for each project design. The analysis and plan should provide:

(1) Type of occupancy.

(2) Type of construction.

(3) Location of fire-rated walls, doors and dampers, including enclosures for hazardous areas.

(4) Exit travel distances.

(5) Horizontal exits.

(6) Occupant load/exit unit widths.

(7) Automatic extinguisher systems.

(8) Fire detection/alarm devices.

(9) Sprinklered areas (as appropriate).

f. Table 4-2 lists typical occupancy loads for facilities.

Table 4-2. Occupancy classification

**TRAINING CENTER BUILDING**

<b>SPACE</b>	<b>OCCUPANCY</b>	<b>REMARKS</b>	<b>OCCUPANCY CLASSIFICATION</b>
Lobby	Varies	-Panic hardware on exterior doors -Door width based on building occupancy load -Push/pull hardware on entrance doors -Safety rails on glass entrance doors &	-Business or assembly if adjacent to assembly hall
Corridor	Varies	-One hour fire rated construction -6'-0" minimum width	-Business
<b>Administrative areas:</b>			
Administrative offices	100 sq.ft./person in exclusive use areas 50 sq. ft./person in common use areas		-Business
Retention office	1-4 Persons		-Business
Conference	20-30 Persons	-Occupancy load based on 15 sq.ft./person	-Business
Message center	2-3 Persons		-Business
Reproduction	1-4 Persons		-Business
Drafting	1-4 Persons		-Business
Communications	2-8 Persons		-Business
Computer equipment	N/A		-Business
<b>Classroom area:</b>			
Classroom	Allow 20 sq.ft./person	See Note 1	-Business
Learning center	Allow 20 sq.ft./person	See Note 2	-Business
Library/classroom	Allow 20 sq.ft./person	Same remarks as Learning Center	-Business
Training aid storage	1 or 2 persons	One hour fire rated construction	-Business
<b>ha</b>			
Assembly hall	50-300 persons maximum	-Enclose with one hour fire rated construction (Class "C") -At an occupancy rate of 7 square feet per person, an authorization of 2100 square feet or greater cannot be "Class C" construction -Number of exits: - minimum of 2 remote exits - 100 persons/unit of exit - 20 ft. maximum common travel distance	-Place of assembly
Maintenance and chair storage	N/A	One hour fire rated construction	-Business
Food preparation		One hour fire rated construction Hoods, cooking surfaces and ducts must have automatic extinguishing systems	-Business
Food Storage	Business	One hour fire rated construction	-Business
Scullery	Business	One hour fire rated construction	-Business
<b>Unit storage area:</b>			
Unit storage	2-3 Persons per each assigned military unit	One hour fire rated construction	-Business
Lockers	Varies	One hour fire rated construction	-Business

Table 4-2. Occupancy classification (Continued)

SPACE	OCCUPANCY	REMARKS	OCCUPANCY CLASSIFICATION
<b>General and special support areas:</b>			
Toilets & showers	Business		-Business
Janitor's closet	N/A	One hour fire rated construction	-Business
Mechanical equipment	N/A	If combustible heat source units are used, provide 1 hour fire rated construction including ceiling	-Business
Arms vault	N/A	An emergency escape device must be provided from the vault interior when the door is locked. Security provisions will be provided.	-Business
Rifle range	7 persons for a 3-lane range. 2 persons will be added for each additional lane		-Business
Medical wing	Varies from 10-30 persons		-Business
Photo lab	2-3 persons		-Business
Soils testing lab	2-3 persons		-Business
SCIF	3-4 persons		-Business
Band room	42 persons		-Business
<b>Organizational maintenance shop:</b>			
OMS-shop office	1-2 persons		-Business
OMS-work bay		See Note 3	-Industrial
OMS-tools & parts	1-3 Persons	If the space exceeds 1,500 sq.ft., it must be separated by a 1 hour fire rated construction	
OMS-storage	1-3 Persons	Same as OMS-tools & parts	-Business
OMS-battery	1-2 Persons	-One hour fire rated construction -Design to NFPA 70 -Sprinklers are not required	-Business
OMS-toilets	N/A	-Provide safe egress to exterior	-Business
OMS-flammable	N/A	-An eyewash/deluge shower should be provided outside of the space	-Industrial high hazard
OMS-mechanical equipment	N/A	-If combustible heat source units are used, provide 1 hour rated construction.	
<b>Area maintenance support activity:</b>			
AMSA-small arms shop	1-2 Persons	-One hour fire rated construction -Sprinklers are not required	-Industrial
AMSA-supply	1-2 Persons		-Storage
AMSA-communications/electronic repair	2-3 Persons	-One hour fire rated construction -Sprinklers are not required	-Industrial
AMSA-breakroom	5-10 Persons	-Safe egress to building exterior	-Business
AMSA-lockers	5-10 Persons	-Safe egress to building exterior	-Business
AMSA-toilets	N/A	-Safe egress to building exterior	-Business

Table 4-2. Occupancy classification (Continued)

NOTE 1. Exception #1: Classrooms with 50 or more occupants will be designed as a place of assembly occupancy.

Exception #2: Portions of buildings which serve a unit, such as a school command, and require a concentration of classrooms will be designed as a place of educational occupancy and will satisfy the following criteria:

- Minimum 2 exits/floor - remote
- Maximum common path of travel - 20 ft.
- Maximum travel distance - 150 ft.

Interior corridor - 6 feet clear corridor width, one hour rating, with 20 minute rating on doors.

Room or space with capacity of over 50 persons, or 1,000 sq.ft., must have two exits which open out.

Minimum one window for ventilation and rescue (clear opening shall not be less than 20 inches wide, 24 inches high, 5.7 sq.ft. in area, with the sill height not more than 44 inches).

NOTE 2. Exception #1: Portions of buildings having classrooms with 50 or more occupants must be designed as a place of assembly occupancy.

Exception #2: Portions of buildings which serve a unit, such as a school command, and require a concentration of classroom must be designed as a place of educational occupancy and satisfy the following criteria:

- Minimum 2 exits/floor - remote
- Maximum common path of travel - 20 feet
- Maximum travel distance - 150 feet.

Interior corridor - 6 feet clear corridor width, one hour rating, with 20 minute rating on doors.

NOTE 3. When the operational requirement is that no repair work is to be done except exchange of parts, maintenance requiring no open flame and welding, or use of highly flammable liquids, the maximum floor area will be 12,000 square feet with no sprinklers for non-combustible construction.

Repair garages will not require sprinklers when the floor area is 9,000 square feet or less for non-combustible construction. See NFPA 88B. Direct egress from the workbays should be provided through a personnel door.

#### 4-7. Energy conservation.

a. Energy conservation through building design has received a great deal of attention in recent times. Tremendous potential exists for trimming energy consumption and operating costs in both new and existing buildings.

b. In compliance with Executive Order 12003, existing facilities must reduce energy consumption by 20 percent of their 1975 energy budget. New facilities should be designed to use 45 percent less energy than a similar building of 1975 vintage.

c. To establish an energy conservation target for existing buildings, an energy budget of the building for 1975 must be determined. Through the use of existing energy consumption data and computer based energy use analysis programs such as BLAST, E-CUBED, TRACE, ESP-II, etc., an approximate energy consumption base line can be determined and the target 20 percent reduction calculated. If complete analysis is required, use the most cost effective of the above programs.

d. For new construction, the target energy budget figures, expressed in BTU's per square foot per year may be obtained from ETL 1110-3-309.

e. Energy conservation opportunities (ECO) should be selected to meet the target energy budget for either new or existing facilities. The ECO will then be analyzed by computer based energy usage simulation techniques. These procedures will model the facility as an entire system so that the interaction of one ECO with another can be analyzed and the net energy savings determined.

f. From the analysis of the various ECOs, the most efficient and cost effective systems which meet the energy budget should be utilized. Cost effectiveness should be based on the life cycle cost. ECOs should demonstrate a simple payback for less than the 25 year life of the building. An ECO's life cycle cost should be calculated in accordance with ETL 1110-3-332.

g. ECOs may be broadly classified into six areas. These classifications and examples of each are listed below.

(1) Site related ECO:

(a) buildings located to utilize winter sun, prevailing winds, and natural land forms.

(b) landscaping and planting to shade the building from summer sun and to block winter winds.

(2) Building envelope ECO:

(a) new or replacement insulation: thicknesses, insulating values, insulation placement, and vapor barriers.

(b) energy efficient windows: reduced glass area, the number of panes, light transmission and reflectivity, type of window construction, window placement, double/triple glazed windows, etc.

(c) protection of windows from direct summer sun: overhangs, shades, blinds, solar films, tinted glass, solar screens and plantings.

(d) weather stripping and caulking to reduce infiltration.

(e) entrance vestibules.

(f) building shapes or frames with low exterior surface to volume ratio.

(g) maximize advantage of winter solar heat gain and natural daylight.

(h) earth contact designs such as full or partial wall berms or underground structures.

(3) Distribution system ECO:

(a) pipe and duct insulation.

- (b) new or replacement steam traps.
- (c) adjustable flow rates on fans and pumps to carefully match load.

(4) HVAC equipment ECO:

- (a) system zones based on the user profile of the building.
- (b) high efficiency boilers, furnaces and unit heaters.
- (c) multiple boilers for better part load efficiencies.
- (d) waste heat recovery devices.
- (e) high efficiency air conditioning equipment.
- (f) time clocks and set back thermostats.
- (g) low leakage dampers.
- (h) economizers.
- (i) high efficiency filters to reduce ventilation and power usage.
- (j) tempered air to exhaust hoods.
- (k) computer based energy management systems.

(5) Domestic hot water ECO:

- (a) insulated water heaters and storage tanks.
- (b) water conserving fixtures.
- (c) time clocks on water heaters.
- (d) waste heat recovery for water heating.
- (e) separate water heaters for kitchen and toilets.

(6) Lighting ECO:

- (a) decreased light levels in non-critical areas.
- (b) high efficiency lamps and ballasts.
- (c) more efficient fixtures, and better lenses.
- (d) task lighting.
- (e) switching to allow for more individual control in unoccupied

areas or naturally lit areas.

(f) high efficiency exterior lighting with time clock or photocell control.

(g) daylighting where possible.

#### 4-8. Public safety/handicapped.

a. Refer to the Occupational Safety and Health Administration (OSHA) for Public Safety related guidelines.

b. The following shall be provided for the physically handicapped:

(1) one designated parking space.

(2) one ramp at the main entrance.

(3) one unisex handicapped restroom on the ground floor.

4-9. Codes. These facilities will be designed in accordance with all Federal codes and other code guidelines contained herein. The Design Agency must verify which local codes, if any, are to be followed.

4-10. Environmental requirements. Environmental requirements such as heating, ventilating, cooling, lighting levels, etc., for the individual spaces in an Army Reserve Training Facility should follow guidelines in Table 4-3.

**TABLE 4-3. Schedule of requirements.**

#### **LEGEND**

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H/O	Heating - Occupied
H/M	Heating - Maintained
C/O	Cooling - Occupied (as authorized by DOD 4270.1-M)
C/M	Cooling - Maintained (as authorized by DOD 4270.1-M)
V(CFM)	Ventilation - Outside Air Cubic Feet Per Minute Per Person
ASN(NC)	Air System Noise - Noise Criteria
SOUND (STC)	Sound - Sound Transmission Coefficient
LIGHT (F.C.)	Light - Footcandles
-	Not Applicable
(1)	Refer to Note 1 - See Legend (Typical for Notes 1-10)

#### **NOTES:**

(1) One air change per hour when occupied

(2) Ten air changes (including outside air changes) per hour when occupied.

(3) Adequate to remove excessive heat developed by equipment.

(4) Gas fired infra-red or electric radiant heat to be provided over the firing line by individual 16,000 BTUH units.

(5) Ventilation should be provided by an exhaust fan located at the target line. Make-up air should be supplied through a perforated wall at the back of the range. An air velocity of 35 FPM is desired ahead of the firing line.

**TABLE 4-3. Schedule of requirements (Continued)****LEGEND**

- (6) See the Definitive Designs for a 600 inch rifle range, Field Design Number FD-28-13-03 and Corps of Engineers-Regulations (CE-R) series specification for acoustical considerations.
- (7) 3/4 CFM/SF of floor area with intake at 18 inches above the finished floor. A separate overhead vehicle exhaust system should be provided.
- (8) Four air changes per hour (including one outside air change).
- (9) Gravity vent or mechanical exhaust. Ventilation equipment to be based on materials to be stored.
- (10) 10 footcandles - explosion proof fixtures.
- (11) Six air changes per hour, including one and one-half outside air changes per hour.
- (12) Two air changes per hour.
- (13) Two speed fan operation. Ten air changes per hour minimum in winter; twenty air changes per hour minimum in summer.
- (14) Provide portable dehumidifier.
- (15) No return air from these spaces.
- (16) Separate system required.

**TRAINING CENTER BUILDING**

	H/O	H/M	C/O	C/M	(V)	(NC) ASN	(STC) SOUND	(F.C.) LIGHT
<b>Circulation:</b>								
Lobby	68	55	-	-	-	-	40	10
Corridor	68	55	-	-	-	-	40	10
<b>Administrative areas:</b>								
Admin. offices	68	55	78	Ambient	5	40	40	50
Retention office	68	55	78	Ambient	5	35	40	50
Conference	68	55	78	Ambient	5	35	40	30
Message center	68	55	78	Ambient	5	35	50	50
Reproduction	68	55	78	Ambient	5 (15)	-	40	30

TABLE 4-3. Schedule of requirements (Continued)

**TRAINING CENTER BUILDING**

	H/O	H/M	C/O	C/M	(V)	(NC) ASN	(STC) SOUND	(F.C.) LIGHT
Drafting	68	55	78	Ambient	5	35	40	50
Communications	68	55	78	Ambient	5	45	40	50
Computer equipment	68	55	78	Ambient	5	35	50	30
<b>Classroom area:</b>								
Classroom	68	55	78	Ambient	5	30	40	50
Learning center	68	55	78	Ambient	5	30	40	50
Library/classroom	68	55	78	Ambient	5	30	40	50
Training aid storage	55	-	-	-	-	-	-	30
<b>Assembly hall:</b>								
Assembly hall	68	55	78	Ambient	5	40	-	50
Maint./chair storage	-	55	-	-	-	-	-	10
Food prep.	68	55	-	-	(2)(15)	-	-	50
Food storage	-	55	-	-	(3)	-	-	30
Scullery	68	55	-	-	(2)	-	-	50
<b>Unit storage area:</b>								
Unit supply	68	55	-	-	(1)	-	-	30
Lockers	68	55	-	-	(2)	-	-	10
<b>General and special support areas:</b>								
Toilets and showers	68	55	-	-	(2)(15)	-	-	30
Janitor's closet	-	55	-	-	(2)	-	-	10

TABLE 4-3. Schedule of requirements (Continued)

## TRAINING CENTER BUILDING

	H/O	H/M	C/O	C/M	(V)	(NC) ASN	(STC) SOUND	(F.C.) LIGHT
Mechanical equip. room electrical/phone space	-	55	-	-	(12)(3)	-	-	30
Arms vault	-	-	-	-	(14)	-	-	50
Rifle range	(4)	45	-	-	(5)(15)	-	(6)	30
Medical wing:								
Corridor	68	55	78	Ambient	(8)	35	40	10
Waiting	68	55	78	Ambient	(8)	35	40	30
Dressing	70	55	78	Ambient	(8)	35	40	10
Medical exam room	68	55	78	Ambient	(8)	35	40	10
Dental exam	68	55	78	Ambient	(11)(15)	35	30	10
Laboratory	68	55	78	Ambient	(11)(15)	35	40	50
Toilets	68	55	78	Ambient	(2)(15)	35	40	10
Sterile supply	68	55	78	Ambient	(11)	35	40	30
Darkroom	68	55	78	Ambient	(2)(15)	35	40	30
PB, EKG, eye exam, ht./wt.	68	55	78	Ambient	(8)	35	30	100
Audiometer room	68	55	78	Ambient	(8)	35	55	50
General supply	68	55	78	Ambient	-	35	40	30
Pharmacy	68	55	78	Ambient	(8)(15)	35	40	50
Photo labs	68	55	78	Ambient	(2)(15)	35	40	50

TABLE 4-3. Schedule of requirements (Continued)

**TRAINING CENTER BUILDING**

	H/O	H/M	C/O	C/M	(V)	(NC) ASN	(STC) SOUND	(F.C.) LIGHT
Soils testing lab	68	55	78	Ambient	5	35	40	50
SCIF	68	55	78	Ambient	5 (16)	35	40	50
Band room	68	55	78	Ambient	5	35	40	50
<b>Organizational maintenance shop:</b>								
Shop office	68	55	78	Ambient	5	40	40	50
Work bay	55	55	-	-	(7)	-	-	30
Tool and parts	55	55	-	-	(1)	-	-	30
Storage	55	55	-	-	(12)	-	-	30
Batteries	-	55	-	-	(11)	-	-	(10)
Toilets	68	55	-	-	(2)	-	-	20
Flammable storage	-	55	-	-	(9)	-	-	(9)
Mechanical equipment	-	55	-	(3)	(13)	-	-	30
<b>Area maintenance support activity:</b>								
Small Arms shop	-	55	78	Ambient	(1)(15)	-	-	50
Vault	-	-	-	-	(14)	-	-	50
Supply	-	55	-	-	(3)	-	-	30
Comm./elec. repair shop	68	55	78	Ambient	(1)	35	-	50
Break	68	55	78	Ambient	(1)	-	-	30
Lockers	68	55	-	-	(2)	-	-	10
Toilets	68	55	-	-	(2)	-	-	10